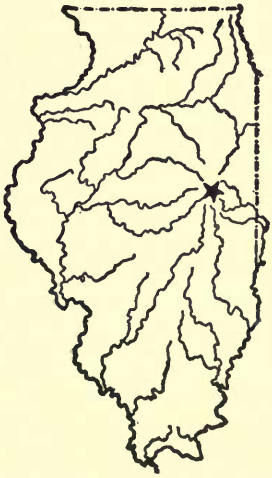
UNIVERSITY OF ILLINOIS
Agricultural Experiment Station

BULLETIN No. 277

COST OF PRODUCING FIELD CROPS IN THREE AREAS OF ILLINOIS 1913-1922

By Emil Rauchenstein and R. C. Ross



URBANA, ILLINOIS, JUNE, 1926

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COST OF PRODUCING FIELD CROPS IN THREE AREAS OF ILLINOIS 1913-1922

By Emil Rauchenstein, Formerly Assistant Chief in Farm Organization and Management, and Robert C. Ross, Associate[1]

INTRODUCTION

During the ten-year period from 1913 to 1922 inclusive, a considerable number of Illinois farmers cooperated with the University in keeping detailed cost accounts on their farms. It is the purpose of this bulletin to present some of the results of these investigations in so far as they apply to crops. The information is presented first, by areas, in order that farmers may use the data as a basis for planning profitable cropping systems; second, by periods, showing the trend of costs and incomes during the pre-war, war, and post-war periods, in order to emphasize the importance of adjusting farm practices to meet general economic conditions; and third, by farms, in order to show variations in costs as affected by management, and the importance of management in determining farm success.

The authors, in this bulletin, have attempted to show the relative profitableness of crops under prevailing farm practices, rather than to study the results of different practices. Sufficient explanation and analysis are added to bring out the significance of the figures and enable the reader to apply them to his own conditions. Costs and income, so far as possible, are expressed in physical terms, that is, in hours of labor, bushels of produce, etc., as well as in money values, since such measures are much more useful in planning profitable systems of farming than are money values, which are constantly changing.

Areas Studied

Detailed cost records have been kept on six to ten farms in Franklin county,[2] and on approximately the same number of farms in Hancock county for the ten-year period 1913-1922. Since March 1, 1920, similar records have been kept on ten to fifteen farms in Champaign and Piatt counties.

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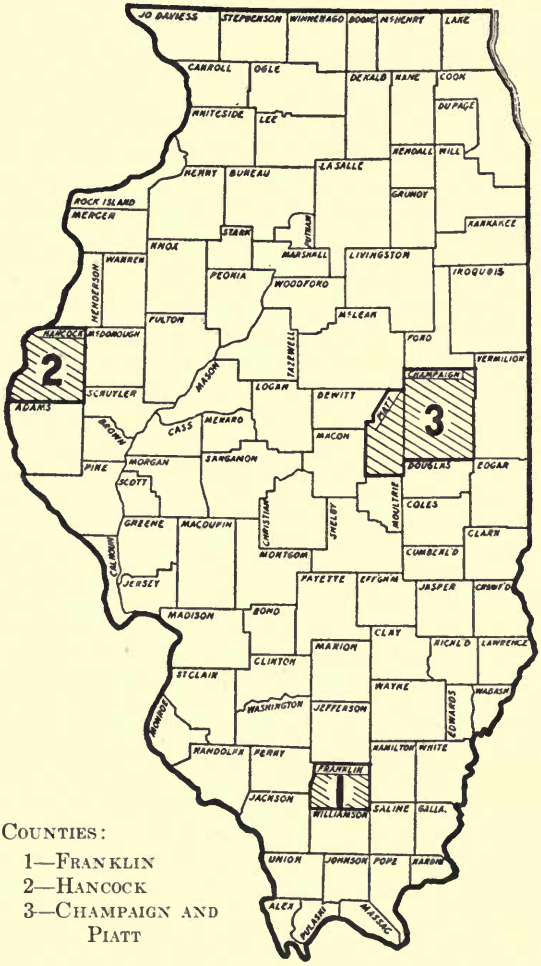
[1]This study was conducted during its entire period under the immediate supervision of Professor Walter F. Handschin, Chief in Farm Organization and Management, whose death occurred in 1922. In addition to some present members of the staff, Messrs. J. B. Andrews, C. A. Bonnen, W. J. Roth, and J. R. Wells, former members of the staff, were at different times associated with the work. Others who served a year or longer in collecting the data from the field include Messrs. F. J. Blackburn, L. R. Caldwell, L. W. Chalcroft, R. F. Howe, C. A. Hughes, G. S. Klemmedson, G. W. Schrider, Dee Small, D. E. Warren, M. H. Watson, and W. W. Wilson. Recognition is also due the farmer-cooperators for their interest and help in securing the data.

[2]During 1920 to 1922 the number of farms in Franklin county on which records were kept decreased to three.

In their production the farms in Franklin County are fairly representative of about fifteen counties in southern Illinois. Thruout this area mixed farming prevails, with no distinct type predominating. Wheat, hay, dairy products, and poultry and eggs are the principal products sold.



COUNTIES:
1—FRANKLIN
2—HANCOCK
3—CHAMPAIGN AND PIATT

LOCATION OF THE AREAS STUDIED

The counties in which these data were secured represent three of the major farming-type areas of the state.

The farms in Hancock county are fairly representative of most of the area between the Illinois and Mississippi rivers, extending as far north as Rock Island county. This is the principal beef cattle and hog area of the state, and altho some farmers specialize in grain and

hay production, relatively small amounts of feed crops are shipped out. Hogs and beef cattle are the chief sources of income, and wheat, rye, poultry, and dairy products the minor products sold.

The farms in Champaign and Piatt counties are typical of about twenty-five counties in east-central Illinois in which grain farming predominates, with general livestock production occupying a minor position. Corn and oats are the principal crops grown and marketed, and wheat is next in importance. Relatively few farmers feed cattle and hogs to any extent, and on most of the farms dairying and poultry raising are of minor importance.

Farmers who were sufficiently interested in cost accounting to keep daily labor records for men and horses, feed records for livestock, records of seed and of production, and an account of all cash received and paid out, were selected as cooperators. During the whole period a field man from the Department of Farm Organization and Management visited each farm from one to four times a month to collect these records and to check their accuracy. A complete double-entry system of bookkeeping, including 68 to 100 accounts for each farm, was kept by the Department.

WAYS IN WHICH COST ITEMS WERE DETERMINED

The costs of crops are grouped under several heads: man labor, horse labor, tractor, seed, machinery, fuel, twine, threshing, general farm expense, miscellaneous expense, and interest on the land.

Man Labor.—Each cooperator kept daily records of all labor. The hour rate was determined by dividing the cash cost for each hired laborer, plus board and other perquisites, by the total number of hours worked. A separate rate was calculated each month. Unpaid family labor was figured at the average rate for hired labor in the county. The total cost of the man labor for each field was then determined.

Horse Labor.—Daily records were kept of the labor performed by all the horses on each farm. The rate per hour was found by dividing the total cost of keeping the horses by the total hours of labor performed. The cost of the horse labor spent on each field was then determined.

Tractor.—Records of tractor use similar to those of man and horse labor were kept. Depreciation on the tractor, however, was charged directly to the profit and loss account. The rate for tractor use was calculated on the basis of expenses other than depreciation. It was decided that as tractors were still somewhat in the experimental stage in 1917 (when the first cooperators began using them), crop costs on tractor farms would be more comparable to those on other farms if the depreciation were charged as a loss to the farm as a whole rather than as an expense to the crops on which the tractors were used.

Seed.—Seed bought was charged at its cost. Home-grown seed was valued at current prices.

Machinery.—Separate accounts were kept for each class of machinery. This division seemed advisable, since crops such as wheat usually require more expensive machinery than corn. The operations performed with each class of machinery were listed with the hours of horse labor used. The total expense of

each class of machinery was then prorated to the fields using that class, in proportion to the number of hours of horse labor used.

Fuel, Twine, and Threshing.—These items were charged directly at current prices and rates.

General Farm Expense.—This item included taxes,[1] automobile expense chargeable to the farm, fencing, miscellaneous labor, tools and vehicles, telephone, farm bureau dues, interest on land used for lanes, and other items that could not be charged directly to any specific productive enterprise. The total was prorated among the productive enterprises, such as crops and productive livestock, on the basis of the man hours spent on each.

During 1922 in Champaign and Piatt counties, taxes made up about 50 percent of the general farm expense, making that item greater than the direct cost of man labor expended on crops.

Miscellaneous Expense.—Such items as limestone, phosphates, clover plowed under for fertilizer, etc., were included here. When divided by the total acreage these sums were so small that they were hardly worth itemizing.

Charges for fertilizing materials purchased were distributed to the crops grown on the fields where such materials had been applied. Limestone was charged in equal amounts to the four succeeding crops, and rock phospate to the ten succeeding crops. No attempt was made to charge the crops for the fertility they removed from the soil, because no satisfactory method has been worked out for its evaluation.

The labor for hauling manure was charged against the first crop following the application, but no charge was made for the fertility contained in the manure.

Interest on Land.—Five percent interest on a conservative market value of the land at the first inventory was charged as an expense of production. Except for improvements this first valuation was kept constant. However, where a comparison was made between individual farms (Table 8), the charge for land was made uniform according to 1913 values.

Distribution of Income

The income from cereals was distributed between grain, roughage (straw or fodder), and pasture. Grain was credited to the fields at husking or threshing time at farm prices, which are current market prices less the cost of marketing. Roughage value was estimated on the basis of market prices, or on the basis of its feeding value compared with some marketable product. Income from pasture was determined by multiplying the number of days a mature cow or her equivalent (in terms of feed consumption) was pastured on the field, by the rate on permanent pastures.

Accounts Summarized in Terms of Efficiency Factors

In order to summarize the cost accounts conveniently, a number of items such as net cost per bushel or ton, and man labor per acre, have been grouped as efficiency factors (Table 1). These summarized items, which serve as measures of the efficiency of production, are self-explanatory, with the possible exception of the net cost per bushel or

[1]Some farm accountants are distributing taxes directly to the land, livestock, etc., a practice which is now being used in farm accounting investigations by this department.

per ton, which was obtained by subtracting from the total expense per acre the income other than from grain in the case of cereals or other than from roughage in the case of hay. The remainder is the net expense of producing grain alone or hay alone.

CROP COSTS SUMMARIZED BY AREAS

FRANKLIN COUNTY

Clover is the outstanding crop in Franklin county for the ten-year period in net profits per acre (Table 1 and Fig. 1). This result, however, is the average of the clover crops where fairly satisfactory stands were secured that were worth leaving over for hay. Expenses incurred on clover crops which failed were charged directly to the profit and loss account. The results would be still more striking for clover if the crop had been credited at commercial rates for nitrogenous fertilizers with the nitrogen added to the soil. But considering only fertilizers actually purchased, clover still leads all other crops in net profit per acre by a margin of nearly $7. Limestone was needed in every case to get a satisfactory stand of clover, and made up a large part of the miscellaneous expense.

Next to clover in net profit per acre is *mixed hay*. The operating expense for this crop was $3 less an acre than for clover, making possible a wide margin ($7.39) between the cost of production and selling price. The general practice in Franklin county of leaving over a good stand of clover mixed with timothy for another year seems to be well justified on the basis of these studies.

Of the forage crops, *timothy* comes next to mixed hay with a net profit of $5.22 an acre, and *redtop* follows with a net profit of $3.80 an acre. Neither of these crops can compete with clover on limed soils, but on soils which are not limed they undoubtedly have a place in the rotation. When grown for feed for young stock on the farm, however, they may have less value compared with clover than the prices used here indicate. Market prices do not necessarily represent correct nutritive values of feeds for young stock. Most of the timothy hay sold is later fed to mature work stock which does not require a high proportion of protein. Protein, which is essential for growth, is furnished much more abundantly in clover hay than in timothy or redtop.

The cost records on *cowpeas* do not cover a large enough acreage to justify definite conclusions as to their place in the cropping system in Franklin county. The results here show a loss of $1.14 an acre. As hay crops they cannot compete with clover on limed soils, since the cost per acre is approximately 60 percent greater and the yield is lower. Where clover has failed, however, they may be used as a substitute crop, since they produce forage high in protein. Since cowpeas

TABLE 1.—SUMMARY OF COST ACCOUNTS ON CROPS, FRANKLIN COUNTY, 1913-1922

Crop	Corn	Wheat[1]	Oats[2]	Clover	Timothy	Mixed hay 1913-19	Redtop	Cowpeas	Soybean hay 1920-22
Expenses per acre									
Man labor	$ 4.65	$ 3.49	$ 2.27	$ 2.16	$ 1.16	$ 1.23	$ 1.11	$ 2.89	$ 2.33
Horse labor	8.99	5.46	3.91	1.91	1.35	1.31	.97	5.32	4.17
Tractor	.21	.54	.22	....	....	....	....	....	....
Seed	.30	2.24	1.48	1.30	.19	.66	.08	2.12	2.79
Machinery	.98	.76	.56	.42	.30	.26	.25	.76	.68
Twine	....	.28	.25	....	....	....	....	....	....
Fuel	....	.04	.04	....	....	....	....	....	....
Threshing or hulling	....	.85	.72	....	....	.15	.47	.33	....
General farm expense	3.46	2.31	1.61	1.32	.91	1.15	.76	2.35	1.21
Miscellaneous	.72	2.11	1.42	1.06	.26	.41	.08	.57	1.17
Total operating expense	19.31	18.08	12.48	8.17	4.17	5.17	3.72	14.34	12.35
Interest on land at 5%	2.19	2.17	2.27	2.31	2.16	2.21	2.56	2.24	2.61
Total expense	$21.50	$20.25	$14.75	$10.48	$ 6.33	$ 7.38	$ 6.28	$16.58	$14.96
Income per acre									
Grain or seed	$21.04	$22.82	$12.31	$.....	$.....	$ .23	$ 2.60	$2.83	$.....
Roughage	.31	2.51	1.71	24.23	10.80	13.91	6.78	12.25	15.14
Pasture	.11	.50	.27	.29	.75	.63	.70	.36	....
Total income	21.46	25.83	14.29	24.52	11.55	14.77	10.08	15.44	15.14
Net profit per acre	$−.04	$ 5.58	$−.46	$14.04	$ 5.22	$ 7.39	$ 3.80	$−1.14	$ .18
Efficiency factors									
Net cost per bu. or ton	$ .90	$ 1.25	$ .60	$ 7.44	$ 6.27	$ 6.90	$ 5.54	$22.05	$14.50
Price per bu. or ton	.90	1.66	.58	17.69	12.12	14.73	12.62	16.65	14.70
Net profit per bu. or ton	−.001	.41	−.02	10.25	5.85	....	....	....	.20
Yield	23.4 bu.	13.75 bu.	21.1 bu.	1.37 ton	.89 ton	.945 ton	.537 ton	.607 ton	1.03 tons
Man labor per acre	25.9 hrs.	19.3 hrs.	12.2 hrs.	10.3 hrs.	7.4 hrs.	8.0 hrs.	6.5 hrs.	16.7 hrs.	11.0 hrs.
Horse labor per acre	53.2 hrs.	36.6 hrs.	23.8 hrs.	12.7 hrs.	8.8 hrs.	8.2 hrs.	6.6 hrs.	32.0 hrs.	22.6 hrs.
Tractor use per acre	.21 hr.	.56 hr.	.23 hr.	.....	.....	.....	.....	.....	.....
Man labor per bu. or ton	1.1 hrs.	1.4 hrs.	.58 hr.	7.5 hrs.	8.3 hrs.	.92 hr.	.....	.....	10.7 hrs.
Total number of acres	1 221.49	1 675.06	1 057.52	608.37	657.72	220.73	196.65	248.49	24.3

[1]Records for 1914-22. [2]No records for 1922.

frequently serve as a substitute crop when other crops fail, it is probable that they were not grown under the most favorable circumstances to show a profit.

Wheat, with a profit of $5.58 an acre, is the only cereal to show a profit for the ten-year period in this county. *Corn* for grain shows a loss of 4 cents an acre, and *oats* a loss of 46 cents. Corn put into the silo can of course be utilized more fully than when grown for grain. This

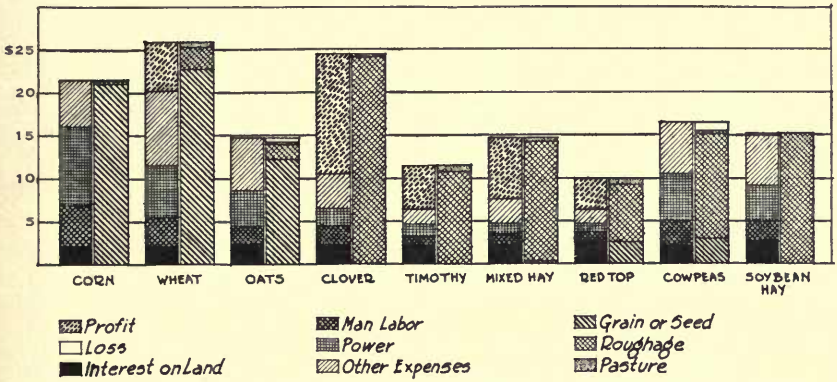


FIG. 1.—COST OF PRODUCING CROPS IN FRANKLIN COUNTY DURING TEN-YEAR PERIOD 1913-1922

In this county clover led all crops in net profit per acre during this period. Mixed hay, wheat, timothy, and redtop also proved profitable. (In this and the following graphs, the various expenses and any profit are represented in the left-hand column, and the income from various sources and any loss are shown in the right-hand column—all expressed in dollars per acre.)

additional value has not been shown in the field accounts, since silage prices are not quoted on the markets. Corn going into the silo has been credited on the basis of grain only and not according to the feeding value of the silage. Then, too, it is the only cultivated (intertilled) crop that has been grown to any extent in Franklin county. The necessity of having a cultivated crop to help control weeds and the need for a silage crop where dairying is becoming more important will probably keep corn in the rotation.

HANCOCK COUNTY

Alfalfa leads all crops in net profit per acre in Hancock county. *Clover* is second only to alfalfa in net profit per acre (Table 2 and Fig. 2). However, this result is the average of the clover crops where fairly satisfactory stands were secured that were worth leaving over for hay or seed. Only a part of the land seeded to clover received an application of limestone, which not only helped in securing a stand, but added to the production per acre. Under these conditions, as in

TABLE 2.—SUMMARY OF COST ACCOUNTS ON CROPS, HANCOCK COUNTY, 1913-1922

Crop	Corn	Wheat[1]	Oats	Clover	Alfalfa	Timothy	Mixed hay	Rye
Expenses per acre								
Man labor	$ 4.27	$ 3.90	$2.31	$ 2.46	$ 3.58	$ 1.71	$ 2.05	$ 3.00
Horse labor	5.83	4.79	2.55	1.87	3.13	1.38	1.76	3.87
Tractor	.37	.87	.19	....	....	....	....	....
Seed	.37	2.29	1.50	1.20	.86	.07	.88	1.63
Machinery	.87	1.23	.71	.73	1.05	.60	.73	.32
Twine	....	.33	.31	....	....	....	....	.40
Fuel	....	.11	.05	....	....	....	....	.09
Threshing or hulling	....	1.30	1.19	1.02	....	.08	....	1.23
General farm expense	2.60	2.53	1.37	1.57	2.05	1.01	1.40	1.71
Miscellaneous	.25	.47	.07	.08	.15	.02	.35	....
Total operating expense	14.56	17.82	10.25	8.93	10.82	4.87	7.17	12.25
Interest on land at 5%	8.30	8.65	8.07	8.23	7.78	7.76	8.60	7.99
Total expense	$22.86	$26.47	$18.32	$17.16	$18.60	$12.63	$15.77	$20.24
Income per acre								
Grain or seed	$30.62	$28.76	$18.52	$8.92	$	$ .46	$ .02	$21.73
Roughage	.05	1.97	1.70	16.27	26.97	12.48	14.03	2.06
Pasture	.78	1.18	.78	1.29	3.83	2.90	1.90	1.33
Total income	31.45	31.91	21.00	26.48	30.80	15.84	15.95	25.12
Net profits per acre	$ 8.59	$ 5.44	$ 2.68	$ 9.32	$12.20	$ 3.21	$ .18	$ 4.88
Efficiency factors								
Net cost per bu. or ton	$ .50	$ 1.08	$ .40	$6.04	$ 7.96	$ 8.82	$11.18	$ .84
Price per bu. or ton	.70	1.33	.47	13.30	14.52	11.78	10.00	1.08
Net profit per bu. or ton	.20	.25	.07	....	....	....	.13	....
Yield	43.70 bu.	21.60 bu.	39.40 bu.	1.15 ton	1.86 tons	1.05 tons	1.41 tons	20. bu.
Man labor per acre	18.20 hrs.	15.20 hrs.	9.70 hrs.	10.10 hrs.	16.5 hrs.	7.5 hrs.	8.7 hrs.	14.6 hrs.
Horse labor per acre	42.3 hrs.	33.20 hrs.	18.5 hrs.	13.0 hrs.	25.7 hrs.	9.0 hrs.	12.4 hrs.	30.6 hrs.
Tractor labor per acre	.32 hr.	.67 hr.	.13 hr.	....	....	....	....	....
Man labor per bu. or ton	.42 hr.	.70 hr.	.25 hr.	....	8.9 hrs.	....	6.17 hrs.	....
Total number of acres	5 030.41	853.54	2 561.87	1 087.67	226.03	1 149.88	366.34	411.96

[1]No wheat grown on cooperating farms in 1913 and 1917.

Franklin county, clover proves its value in the rotation entirely aside from its merits as a soil builder. Considerable increase in the acreage of alfalfa and clover is certainly justified on the basis of these records.

Timothy shows a higher net profit than mixed hay; however, mixed hay leads when the relative value of these two crops is considered as feed for growing livestock on the farm.

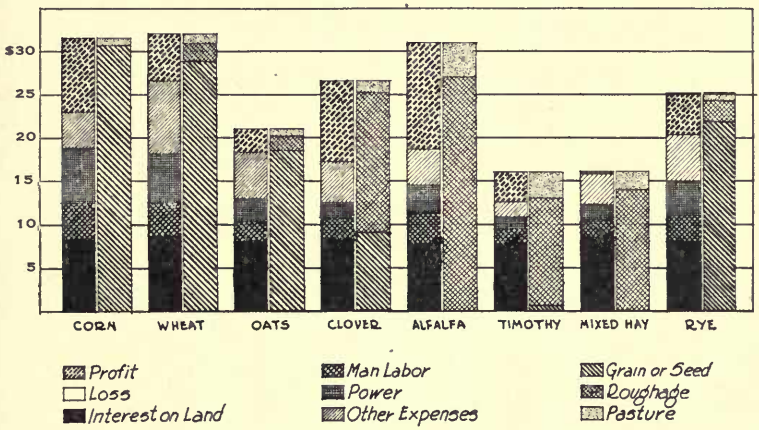


FIG. 2.—COST OF PRODUCING CROPS IN HANCOCK COUNTY DURING TEN-YEAR PERIOD 1913-1922

In Hancock county all crops returned some profit during this period. Alfalfa, clover, corn, and wheat were the more profitable crops.

Corn leads all cereals, and is next to clover with a net profit per acre of $8.59. *Wheat* comes second with $5.44 net profit per acre, and rye third with $4.88. Since wheat and rye require labor at practically the same time of the year, wheat is usually grown on the more fertile soil, and rye on the poorer soil.

Oats, as a crop by itself, is the least profitable of the cereals. In combination with other crops, however, it occupies a place which is difficult to fill with any other crop. The labor on oats interferes very little with corn or wheat, the crop occupies the ground for a shorter time than these grains, and is a good nurse crop for the seeding of clover or alfalfa. Oats are usually sown on land that has grown two or more cereal crops since a legume, and consequently do not have as good an opportunity of returning a profit as corn, which is usually grown on the most fertile land. Oats cannot be put on very fertile land because of the danger of lodging, but coming the third year following a legume oats probably would give a net return comparable to that secured from a third year of corn.

COSTS IN FRANKLIN AND HANCOCK COUNTIES COMPARED

A study of average net costs of various crops for the ten-year period in Franklin and Hancock counties shows that each area has special conditions which favor the production of certain crops. For convenience the net costs per bushel or per ton given in Tables 1 and 2 are repeated here.

	Corn	Wheat	Oats	Clover	Alfalfa	Timothy	Mixed hay	Red-top	Cow-peas	Rye
Franklin Co. 1913-22	$.90	$1.25	$.60	$7.44	.....	$6.27	$6.90	$5.54	$22.05	....
Hancock Co. 1913-22	$.50	$1.08	$.40	$6.04	$7.96	$8.82	$11.18	.....	.....	$.84

Of the five main crops grown in the two counties—corn, wheat, oats, clover, and timothy—the farms in Hancock county produce all but timothy at a lower net cost than the farms in Franklin county.

TABLE 3.—SUMMARY OF COST ACCOUNTS ON CROPS, CHAMPAIGN AND PIATT COUNTIES, 1920-1922

Crop	Corn	Wheat	Oats	Clover	Soybeans 1922
Expenses per acre					
Man labor	$ 4.30	$ 2.85	$ 1.67	$ 1.56	$ 2.69
Horse labor	5.65	4.06	2.05	1.34	5.10
Tractor labor	.79	.84	.29	....	.46
Seed	.31	2.18	1.44	2.37	1.85
Machinery	.90	1.33	.54	.72	1.06
Twine	....	.30	.28	....	.31
Fuel	....	.12	.11	....	.22
Threshing or hulling	....	1.02	.95	.83	1.10
General farm expense	4.58	3.38	2.22	1.91	3.66
Miscellaneous	.18	.05	.01	....	....
Total operating expense	16.71	16.13	9.56	8.73	16.45
Interest on land at 5%	12.88	12.40	12.74	11.82	12.59
Total expense	$29.59	$28.53	$22.30	$20.55	$29.04
Income per acre					
Grain or seed	$22.31	$26.68	$13.95	$ 4.90	$17.64
Roughage	.12	2.33	2.39	11.33	5.58
Pasture	.85	.84	.72	2.40	1.14
Total income	23.28	29.85	17.06	18.63	24.36
Net profits per acre	$−6.31	$ 1.32	$−5.24	$−1.92	$−4.68
Efficiency factors					
Net cost per bu. or ton	$ .60	$ 1.31	$ .61	$14.90	$ 1.89
Price per bu. or ton	.45	1.22	.38	12.20	1.15
Net profit per bu. or ton	−.13	.06	−.14	....	−.30
Yield	49.2 bu.	21.8 bu.	36.7 bu.	.89 ton	15.3 bu.
Man labor per acre	14.4 hrs.	12.0 hrs.	6.7 hrs.	6.1 hrs.	13.9 hrs.
Horse labor per acre	33.5 hrs.	25.1 hrs.	11.9 hrs.	8.2 hrs.	31.4 hrs.
Tractor use per acre	.7 hr.	.49 hr.	.23 hr.	.....	.72 hr.
Man labor per bu. or ton	.29 hr.	.55 hr.	.18 hr.	.....	.91 hr.
Total number of acres	2 838.95	649.06	1 995.81	448.00	182.89
Hancock county price, 1913–22	$ .70	$ 1.33	$ .47	$13.30	

On crops requiring little labor Franklin county has low costs per acre mainly because of the low land charges; hence the amount raised does not need to be large to show a fair return. Of the minor crops, the farms in Franklin county produce mixed hay at a lower cost than the farms in Hancock county. Because of soil and climatic conditions, Hancock county has the greater advantages in the production of corn and oats. During the 1913-22 period the Hancock county farms produced corn at a cost of 40 cents less a bushel, and oats at a cost of 20 cents less a bushel than the Franklin county farms.

The advantage of wheat over corn and oats in Franklin county is shown clearly by a comparison of the net costs of production. The net cost of producing one bushel of wheat is $1.25 compared with 90 cents

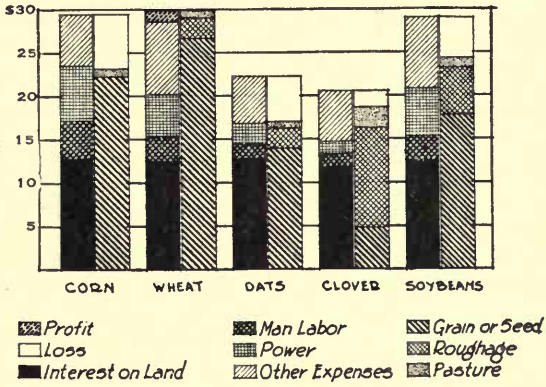


FIG. 3.—COST OF PRODUCING CROPS IN CHAMPAIGN AND PIATT COUNTIES DURING 1920-1922

In this area and during these three years wheat was the only crop returning a profit. Unbalanced price relationships and high land charges were responsible for this fact.

for one bushel of corn. Average farm prices in Franklin county at harvest and husking time were $1.66 for wheat and 90 cents for corn. Expressed in percentages, corn costs 72 percent as much to produce as wheat, altho the price is only 54 percent as high, and oats cost 48 percent as much to produce as wheat, with the price only 35 percent as high.

On the farms in Hancock county corn is slightly more profitable than wheat, costing only 46 percent as much to produce as wheat, while the price of corn is 52.5 percent as high as wheat. Oats cost 37 percent as much to produce as wheat and the price of oats is 35.3 percent as high as wheat.

From these relative costs of producing crops one may conclude that in Franklin county wheat and clover should form important parts of a profitable rotation on limed soils. On unlimed soils wheat and timothy or redtop should make up important parts of the rotation. The limited cost records available on soybeans indicate that they may replace part of the corn to meet the need for a cultivated (intertilled) crop or may replace oats in the rotation. They are especially valuable as a hay crop when clover fails to grow.

In Hancock county corn, clover, and alfalfa have the advantage of low production costs. Wheat or oats, or both, are needed in the rotation to serve as nurse crops for clover.

CHAMPAIGN AND PIATT COUNTIES

Wheat is the only crop that shows a net profit for 1920-22 in Champaign and Piatt counties. If the price of corn had been in its usual ratio to wheat, profits on corn would have been slightly greater than those on wheat. Corn and wheat cost almost the same per acre to produce when wheat follows oats in the rotation, as it did in practically all cases here. The cost of producing an acre of soybeans for the year 1922 fell between the cost of corn and that of wheat for the period, and was a little higher than that of corn ($28.39) and wheat ($27.93) for 1922.

The high interest charge on land in this area in 1920-22 causes those crops which bring in low incomes per acre and which therefore have to depend for profits mainly upon low expenses, to show up at a disadvantage. Oats, especially, belong to this class. Clover fails to show a profit mainly because of low yields, which were much below the possibilities in this area, especially on soil where limestone has been properly applied.

It is believed that, on an average, the expenses of production on the various crops shown in Table 3 will remain in about the same ratio to each other over a number of years or as long as the same cultural practices are followed. Neither the crop yields nor the prices for the three years 1920-22 are representative, however, of a long-time average, and anyone using Table 3 to determine which rotation will bring the largest net income, must estimate his own expected income per acre from each of these crops.

A change in cultural practice, such as drilling wheat in soybean stubble with no extra soil preparation, reduces the man labor, machinery expense, and general farm expense on wheat about one-half, and the horse and tractor costs about two-thirds. On this basis, the expenses of producing an acre of wheat (Table 3) would be reduced by about $7, under present conditions. The effect of this practice on wheat yields has varied so widely on different fields that no general recommendation about the practice is offered at this time.

PROFITABLE CROP ROTATIONS

The purpose of cost-of-production studies is primarily to find out how farms may be made more profitable. This may be accomplished thru the selection of those crops and livestock enterprises which, when combined, will give large returns and provide for efficient operation.

The data already presented show the relative profitableness of different crops, based on the farm practices in the regions studied. On the farms studied no complete plan of soil improvement had been carried out for all fields. Better soil treatment, improved methods of production, and the selection of high-yielding varieties might have added more to the profits of some crops. Such improved practices over a period of time may affect also the relative profitableness of crops in an area.

The data presented here provide only part of the information needed in combining different crops in a rotation in such a way as to give the maximum net return to the farmer. Other factors, such as probable price; control of weeds, plant diseases, and insects; risk of crop failure; the sequence of crops; feed requirements of livestock; the physical layout of the farm; the available supply of labor; and the yields that may be obtained with various crop rotations, must be considered in selecting the most profitable crop rotation.

Profitable Combinations for Franklin County Area

Crop rotations have not been so well standardized for the mixed-farming area of southern Illinois as for the areas that are commonly included in the corn belt. However, the foregoing data showing the costs of production and incomes from various crops, and their comparative values in a general cropping system, furnish a basis for determining profitable combinations of crops for this area. Wheat and clover—the crops which in this study returned the greatest profits—should make up the major part of the rotation. Corn, altho produced at a slight loss, fills a needed place as an inter-tilled crop and provides necessary feed. Where hay is desired as a cash crop, timothy or redtop may be added. These crops may be combined into four- or five-year rotations.

FOUR-YEAR ROTATIONS

(1) First Year—Corn
Second year—Wheat (with clover)
Third year—Clover
Fourth year—Wheat (with clover or clover and grass)

(2) First year—Corn
Second year—Wheat (with clover and grass)
Third year—Clover and grass
Fourth year—Grass (timothy or redtop)

FIVE-YEAR ROTATIONS

(1) First Year—Corn
Second year—Wheat (with clover and grass, or clover)
Third year—Clover, or clover and grass
Fourth year—Wheat (with clover)
Fifth year—Clover

(2) First year—Corn
Second year—Wheat (with clover and grass)
Third year—Clover and grass
Fourth year—Grass (timothy or redtop)
Fifth year—Grass (timothy or redtop)

Of the four-year rotations, the first would be somewhat more profitable but has the disadvantage of a peak of labor requirements during the period of ground preparation and wheat seeding. The five-year rotations differ from the corresponding four-year rotations in that the clover or grass seeding is let stand the fifth year. In the first of the five-year rotations red clover may be sown with the second crop of wheat if hay is desired, or sweet clover may be used to furnish pasture. Altho this rotation requires more labor than the second five-year rotation, it includes a larger proportion both of the maximum-profit crops and of legume crops.

On some of the farms included in this study, limestone had not been applied and clover could not be grown. These are representative of a considerable number of farms in this area which, because of initial cost or long distances from shipping points, have not applied limestone. On such farms crop yields are limited to the amounts which can be grown by returning the crop wastes or the manure which is secured from feeding the crops.

The influence of the application of limestone and the growing of legumes on the yield of grain crops in this area is well illustrated by the results secured by the Agronomy Department of this Station on the Ewing soil experiment field in Franklin county. In a rotation of corn, oats, clover, and wheat the average yields of corn for the ten-year period covered by this study afford a striking comparison of results secured when soil treatment is limited to crop residues or manure, with those secured with the same materials when limestone has been applied.

Soil treatment	*Average yield of corn (bushels) 1913-1922*[1]
Crop residues	11.3
Manure	20.2
Crop residues and limestone	27.9
Manure and limestone	34.2

Other grain crops gave comparable increases when limestone was applied. Upon this basis the expenditure of money and labor in apply-

[1]Data furnished by Agronomy Department.

ing limestone would greatly increase the profitableness of rotations in this area by making possible the growing of clover—the maximum-profit crop—as well as by increasing the yields of other crops.

Until such time as the available capital and labor make possible the more general application of limestone, a rotation of corn, wheat (with timothy), timothy, and timothy seems best adapted to unlimed soils. Redtop, altho less profitable, may be used in place of timothy.

The acreage of cowpeas and soybeans included in the cost studies of this area is too limited to justify definite conclusions as to the place of these crops in a profitable cropping system.

Profitable Combinations for Hancock County Area and Champaign and Piatt County Area

A number of rotations have been suggested by the Agronomy Department of this Station as suited to a program of permanent soil improvement for the corn belt. These are published in Soil Reports 19 to 30 of this Station. From these rotations the following would be selected, on the basis of these cost studies, as particularly desirable for the Hancock area and the Champaign and Piatt county area.

FOUR-YEAR ROTATIONS

(1) First Year—Corn
Second year—Oats (with clover)
Third year—Clover
Fourth year—Wheat (with sweet clover)

(2) First year—Corn
Second year—Corn
Third year—Oats (with clover)
Fourth year—Clover

FIVE-YEAR ROTATION

First Year—Corn
Second year—Corn
Third year—Oats (with clover or clover and grass)
Fourth year—Clover or clover and grass
Fifth year—Wheat (with sweet clover)

These rotations are built around corn or corn and wheat as grain crops, with clover as the legume. With each of these rotations a large proportion of the land is devoted to highly profitable crops.

Since this study includes only one year's record for soybeans, no attempt is made to determine their place in profitable cropping systems for these areas.

Alfalfa seeded on well-prepared land, according to the results secured in these cost studies, should increase the profitableness of any cropping system. Because of the conflict of labor demands in haymaking with those of corn cultivation, and the large total tonnage of hay secured from a large field of alfalfa, many farmers prefer to grow this crop in a smaller field outside the rotation rather than to make

it a part of the rotation. When added to a four- or five-year rotation, alfalfa may be grown on one field while the other crops rotate once around; when the rotation period has been completed, the alfalfa is moved to another field.

CROP COSTS SUMMARIZED BY PERIODS

The ten-year period, 1913-1922, may be logically divided into three shorter periods based upon marked price changes. The first period, 1913-16 inclusive, may be called the pre-war period; the second period, 1917-19 inclusive, the war period; and the third period, 1920-22 inclusive, the post-war period.

Thruout the *pre-war period* the farm prices of crops, except wheat, remained at nearly the same level. Wheat prices rose approximately 25 cents a bushel in 1915 and again in 1916. Operating expenses on farms remained about the same during these four years.

The *war period* brought a large and rapid increase in the prices of grains. The price of wheat more than doubled and the price of other crops increased from 50 to 100 percent. Tho operating expenses increased steadily, they lagged two to three years behind the increases in prices of crops, and the immediate effect of these changes was to make all grain production profitable, especially wheat, which enjoyed the greatest increase in price. Those who quickly increased their wheat acreage, increased their profits accordingly. In so far, then, as price increases can be foreseen, a farmer will increase the acreages of those crops which are in demand.

The *post-war period* was marked by a sudden drop in prices in the closing months of 1920. At threshing time the prices of wheat and oats were still high. By the time corn was husked its price was less than one-half that of 1919. The price decline affected small grains correspondingly in 1921 and 1922. Corn fell to the low level of 32 cents a bushel at husking time in 1921, but recovered somewhat by 1922. The decline in operating expenses lagged behind that of prices and had little effect on the 1920 crops. In 1921 and 1922 the decline in operating expenses was less abrupt than the earlier drop in prices, and for this period operating expenses stood about 50 percent above the pre-war period. The relation of grain prices and cost of production made this period one of small profits or of actual losses.

When, for a particular crop, a decline in prices seems certain, especially when production costs are high, the individual farmer may shift production, so as to produce less of that crop and more of a more profitable crop. If, however, as more commonly happens, the drop in prices of farm crops is general, the best thing for him to do is to reduce cash expenditures as far as possible, and get the largest possible returns from his own labor and that of his family and from the equipment he already has on hand.

TABLE 4.—SUMMARY BY PERIODS OF COST ACCOUNTS ON CORN

County	Franklin			Hancock			Champaign and Piatt
Period	1913–16	1917–19	1920–22	1913–16	1917–19	1920–22	1920–22
Expenses per acre							
Man labor	$ 3.63	$ 4.59	$ 6.33	$ 3.32	$ 4.43	$ 5.14	$ 4.30
Horse labor	5.89	9.82	11.78	5.01	6.64	5.90	5.65
Tractor	.....	.33	.25	.....	.32	.81	.79
Seed	.17	.38	.35	.25	.47	.40	.31
Machinery	.73	.90	1.52	.65	.86	1.13	.90
General farm expense	2.84	3.80	3.64	2.19	2.04	3.62	4.58
Miscellaneous	.17	.69	1.61	.19	.42	.15	.18
Total operating expense	13.43	20.51	25.48	11.61	15.18	17.15	16.71
Interest on land at 5%	2.18	2.21	2.17	7.81	7.64	9.54	12.88
Total expense	$15.61	$22.72	$27.65	$19.42	$22.82	$26.69	$29.59
Income per acre							
Grain	$11.03	$30.61	$14.10	$20.84	$45.71	$24.65	$22.31
Soybeans	.....	.....	.20	.....	.31	.57	.....
Roughage	.30	....	.55	.....	.04	.03	.12
Pasture	.32	.21	.06	.48	.78	1.12	.85
Total income	11.65	30.82	14.91	21.39	46.84	26.37	23.28
Net profit per acre	$−3.96	$ 8.10	$−12.74	$ 1.97	$24.02	$−.32	$−6.31
Efficiency factors							
Net cost per bu	$ .88	$ .78	$ 1.30	$ .53	$ .53	$ .48	$ .58
Price per bu	.65	1.06	.68	.58	1.08	.47	.45
Net profit per bu	−.23	.28	−.62	.05	.55	−.01	−.13
Yield	16.9 bu.	28.9 bu.	20.7 bu.	36.1 bu.	42.2 bu.	52.2 bu.	49.2 bu.
Man labor per acre	26.0 hrs.	26.0 hrs.	25.8 hrs.	18.7 hrs.	18.8 hrs.	17.0 hrs.	14.4 hrs.
Horse labor per acre	46.9 hrs.	57.5 hrs.	53.0 hrs.	44.1 hrs.	43.6 hrs.	39.1 hrs.	33.5 hrs.
Tractor use per acre	.....	.23 hr.	.50 hr.	.....	.24 hr.	.77 hr.	.70 hr.
Man labor per bu	1.54 hrs.	.90 hr.	1.24 hrs.	.52 hr.	.45 hr.	.33 hr.	.29 hr.
Total number of acres	384.83	582.21	254.45	1 757.74	1 676.80	1 595.87	2 838.95

COST OF CORN DURING DIFFERENT PERIODS

Corn was considerably more profitable in Franklin county during the war period than before or after that time (Table 4 and Fig. 4). During the pre-war period the net loss per acre was $3.96; during the war period there was a profit of $8.10; and during the post-war period a loss of $12.74. The total income per acre during the war period increased 165 percent over that of the first period. This was due both to more favorable seasons for corn, which resulted in an increase in average yields from 16.9 to 28.9 bushels, and to the higher price level which prevailed.

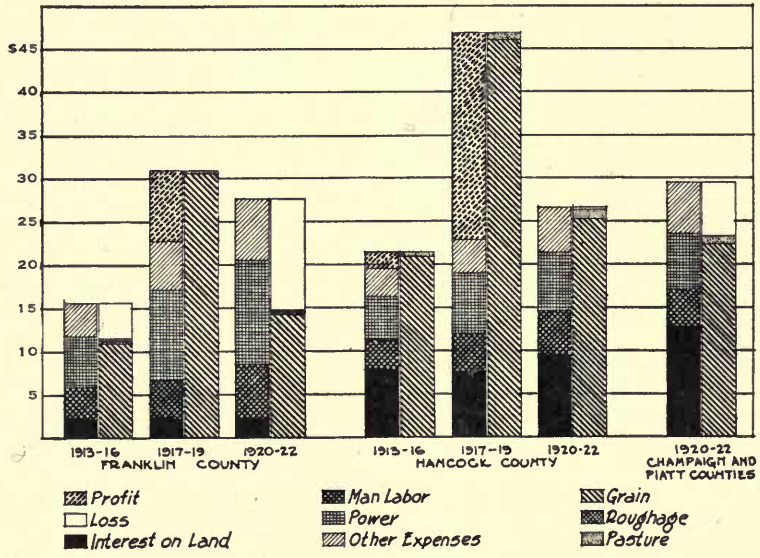


FIG. 4.—COST OF PRODUCING CORN DURING PRE-WAR, WAR, AND POST-WAR PERIODS

During the war period favorable seasons and high prices combined to make corn profitable. High operating expenses and low prices resulted in a loss in the last period.

The income during the last period dropped to 28 percent above that of the pre-war period. However, operating expenses on corn in Franklin county increased steadily or, expressing the increase in percentages of the first period, 52 percent in the second, and 90 percent in the third. The net profit per acre on corn in Hancock county during the first two periods was $1.97 and $24.02 respectively; this was changed to a loss of 32 cents an acre in the third period (Table 4). The gross income was influenced by wide differences in average yields, as well as by price levels. The yields averaged 36.1, 42.2, and 52.2 bushels during the three periods.

Climatic conditions, and in the last period, improved farm practices on some of the farms, such as plowing under sweet clover catch crops, accounted for the above differences in yield. Operating expenses, however, increased steadily; expressed in percentages of the first period, these increases amounted to 30 percent in the second period and 48 percent in the third. Tractors were introduced on some farms in the second and third periods, influencing the amount of horse labor used and the total power cost. The charge for interest on land showed a marked increase in the last period due to the fact that some new farms with higher land values were included in the cost accounting studies. At that time an acre of Hancock county land was valued at $50 to $150 higher than it was during the pre-war period.

The net loss per acre on corn in Champaign and Piatt counties during the 1920-22 period was $6.31, as compared with a loss of 32 cents in Hancock county, which has similar conditions of climate and a soil of lighter texture. The smaller total income per acre in Champaign and Piatt counties was due primarily to a lower yield, a somewhat lower price, and less credit for by-products. Altho operating expenses were less, the total expense on corn in Champaign and Piatt counties was higher than in Hancock county due to the higher charge for interest on land. Land in Champaign and Piatt counties generally sells at a higher price than in Hancock county; moreover, the records on these farms were started in March, 1920, when land prices were near the peak for the entire period covered by this study. Average values of about $250 an acre seemed to be conservative at that time.

COST OF WHEAT DURING DIFFERENT PERIODS

Wheat in Franklin county paid better than corn during all three periods (Table 5 and Fig. 5). In the first period the net loss was $2.57 per acre; in the second this was changed to a profit of $17.15; and a loss of $4.93 occurred in the third. The large profit of the war period was due to favorable seasons with good yields and to high grain prices. The increasing rates of man and horse labor, some tractor expense, and considerable increases from period to period in miscellaneous expenses, which on these farms were made up mainly of purchased fertilizers, increased operating expenses constantly, altho the amounts of man and horse labor were materially reduced in the last period.

During the first period in Hancock county the net loss per acre on wheat was $5.95 (Table 5). Favorable seasons and prices combined to return a net profit of $26.65 in the second period; the third period, due to reduced yields and prices, gave a profit of only $2.79. Except for the use of purchased fertilizers, the conditions influencing operating costs were similar to those in Franklin county. During the second and third periods, records were started on several new farms, whose land

TABLE 5.—SUMMARY BY PERIODS OF COST ACCOUNTS ON WHEAT

County	Franklin			Hancock			Champaign and Piatt
Period	1914–16	1917–19	1920–22	1914–16	1918–19	1920–22	1920–22
Expenses per acre							
Man labor	$ 3.22	$ 3.57	$ 3.67	$3.13	$ 4.39	$ 3.98	$ 2.85
Horse labor	4.95	5.40	6.12	5.72	6.02	4.15	4.06
Tractor	.....	.80	.68	.....	1.57	.93	.84
Seed	1.50	2.68	2.29	1.43	3.08	2.32	2.18
Threshing	.45	1.10	.85	.76	1.49	1.40	1.02
Fuel	.01	.02	.10	.03	.....	.17	.12
Twine	.06	.41	.31	.13	.64	.30	.30
Machinery	.70	.66	.98	1.01	1.37	1.26	1.33
General farm expense	2.35	2.46	2.02	2.36	2.15	2.70	3.38
Miscellaneous	.66	1.81	4.13	.78	.50	.37	.05
Total operating expense	13.90	18.91	21.15	15.35	21.21	17.58	16.13
Interest on land at 5%	2.13	2.18	2.17	7.67	8.32	9.05	12.40
Total expense	$16.03	$21.09	$23.32	$23.02	$29.53	$26.63	$28.53
Income per acre							
Grain	$10.98	$34.43	$16.17	$15.29	$52.09	$26.12	$26.68
Roughage	1.86	3.27	1.93	.95	2.82	2.04	2.33
Pasture	.62	.54	.29	.83	1.27	1.26	.84
Total income	13.46	38.24	18.39	17.07	56.18	29.42	29.85
Net profit per acre	$−2.57	$17.15	$−4.93	$−5.95	$26.65	$ 2.79	$ 1.32
Efficiency factors							
Net cost per bu.	$ 1.22	$ 1.08	$ 1.64	$ 1.35	$ 1.01	$ 1.05	$ 1.16
Price per bu.	.99	2.15	1.26	.97	2.07	1.17	1.22
Net profit per bu.	−.23	1.07	−.38	−.38	1.06	.125	.06
Yield	11.10 bu.	16.00 bu.	12.80 bu.	15.80 bu.	25.10 bu.	22.30 bu.	21.80 bu.
Man labor per acre	21.80 hrs.	20.80 hrs.	14.40 hrs.	18.80 hrs.	17.20 hrs.	13.50 hrs.	12.00 hrs.
Horse labor per acre	39.10 hrs.	41.00 hrs.	26.60 hrs.	43.80 hrs.	45.10 hrs.	26.60 hrs.	25.10 hrs.
Tractor use per acre	.....	.56 hr.	1.14 hrs.	.....	1.00 hr.	.77 hr.	.49 hr.
Man labor per bu.	1.96 hrs.	1.30 hrs.	1.12 hrs.	1.19 hrs.	.68 hr.	.61 hr.	.55 hr.
Total number of acres	478.09	746.20	450.77	161.21	154.05	538.28	649.06

values were influenced by the increasing market prices from 1917 to 1920. The increase in the charge for land on these farms raised the average for the whole group.

The total income for wheat in Champaign and Piatt counties in the post-war period was approximately the same as that in Hancock county (Table 5). Operating expenses were lower, due to the use of

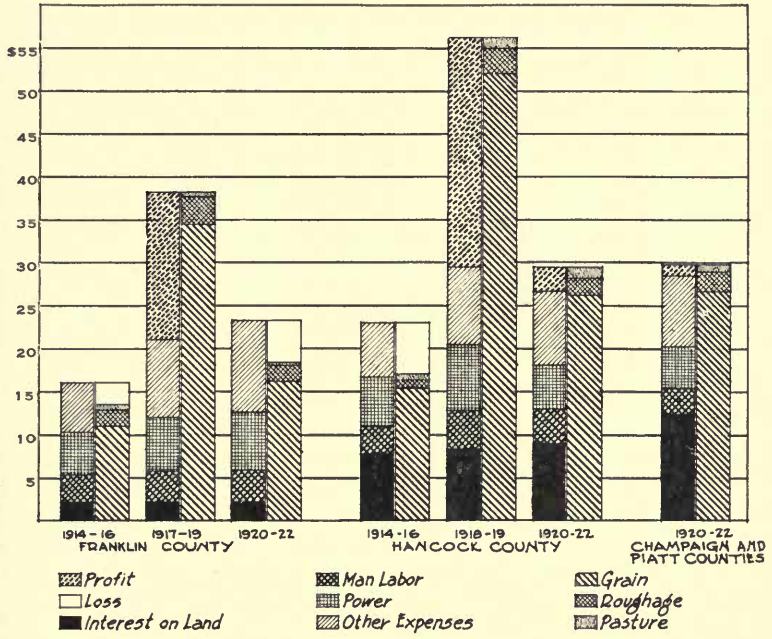


FIG. 5.—COST OF PRODUCING WHEAT DURING PRE-WAR, WAR, AND POST-WAR PERIODS

Wheat changed from a non-profit crop in the pre-war period to a very profitable crop during the war period. In the post-war period wheat was more profitable than corn in all areas.

less man labor and power. The higher charge for interest on land raised the total expense nearly two dollars an acre above that of Hancock county, and reduced the net profit per acre to $1.32.

COST OF OATS DURING DIFFERENT PERIODS

Oats in Franklin county have a relatively higher price than in the other two areas, due partly to the fact that oats are frequently bought in Franklin county and so are given a price to cover the cost of shipping them in and hauling them to the farm. With this higher price, oats were grown at a loss of $3.38 per acre in the first period, a net profit of $3.55 in the second, and a loss of $1.92 in the third (Table 6

TABLE 6.—SUMMARY BY PERIODS OF COST ACCOUNTS ON OATS

County	Franklin			Hancock			Champaign and Piatt
Period	1913–16[1]	1917–19	1920–21[2]	1913–16	1917–19	1920–22	1920–22
Expenses per acre							
Man labor	$ 1.66	$ 2.55	$ 2.93	$ 1.71	$ 2.68	$ 2.49	$ 1.67
Horse labor	3.06	4.14	5.08	1.97	3.28	2.27	2.05
Tractor	....	.05	.95	....	.22	.35	.29
Seed	.97	1.68	2.09	.90	1.78	1.80	1.44
Threshing	.32	1.02	.97	.67	1.52	1.35	.95
Fuel	....	.02	.13	.06	....	.09	.11
Twine	.07	.39	.35	.14	.50	.29	.28
Machinery	.44	.56	.81	.72	.57	.87	.54
General farm expense	1.25	1.84	1.92	1.21	1.28	1.64	2.22
Miscellaneous	.24	1.16	4.10	.02	.06	.14	.01
Total operating expense	8.01	13.41	19.33	7.40	11.89	11.29	9.56
Interest on land at 5%	2.05	2.42	2.41	7.64	7.77	8.88	12.74
Total expense	$10.06	$15.83	$21.74	$15.04	$19.66	$20.17	$22.30
Income per acre							
Grain	$ 5.45	$17.00	$17.12	$ 9.68	$27.64	$16.74	$13.95
Roughage	1.05	2.06	2.37	.89	2.28	1.84	2.39
Pasture	.18	.32	.33	.45	1.08	.77	.72
Total income	6.68	19.38	19.82	11.02	31.00	19.35	17.06
Net profit per acre	$−3.38	$ 3.55	$−1.92	$−4.02	$11.34	$−.82	$−5.24
Efficiency factors							
Net cost per bu.	$ .67	$ .49	$ .77	$ .46	$ .34	$ .45	$ .52
Price per bu.	.415	.61	.69	.32	.575	.43	.38
Net profit per bu.	−.255	.12	−.08	−.14	.235	−.02	−.14
Yield	13.2 bu.	27.7 bu.	24.9 bu.	29.6 bu.	48.2 bu.	39.1 bu.	36.7 bu.
Man labor per acre	11.7 hrs.	13.1 hrs.	11.6 hrs.	19.9 hrs.	10.8 hrs.	8.1 hrs.	6.7 hrs.
Horse labor	25.1 hrs.	24.2 hrs.	20.9 hrs.	18.7 hrs.	20.5 hrs.	15.7 hrs.	11.9 hrs.
Tractor use	.....	.03 hr.	1.00 hr.	.....	.14 hr.	.26 hr.	.23 hr.
Man labor per bu.	.89 hr.	.474 hr.	.47 hr.	.....	.22 hr.	.21 hr.	.18 hr.
Total number of acres	432.07	396.40	229.05	757.16	989.19	815.52	1 995.81

[1]All oats cut for hay in 1914 and none threshed.
[2]No data available for 1922—crop failure.

and Fig. 6). The same conditions which caused increasing operating expenses with wheat likewise affected oats, so that operating expenses, expressed in percentages of the first period, increased 67 percent in the second period and 140 percent in the third.

In Hancock county three years of the first period were unfavorable to oats production (1913, 1914, and 1916). The low yields which resulted, combined with the low price, gave a loss of $4.02 an acre for

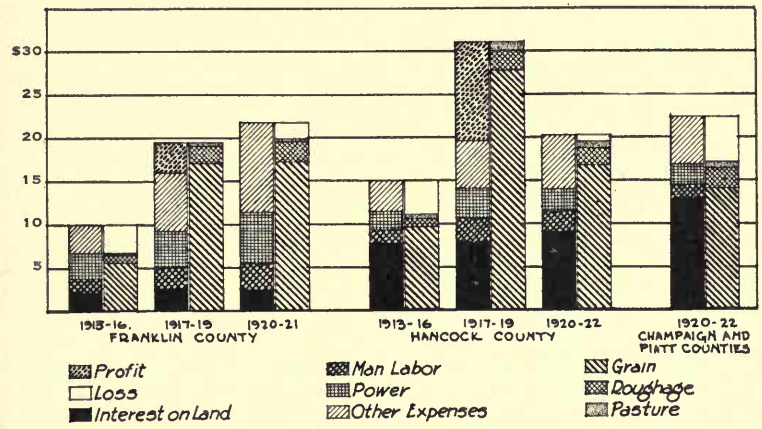


FIG. 6.—COST OF PRODUCING OATS IN PRE-WAR, WAR, AND POST-WAR PERIODS

Oats are the least profitable of the cereal crops. They are grown because of the place they fill in the rotation, rather than as a direct profit crop.

the period (Table 6). The second period had favorable seasons and good prices, and returned a net profit of $11.34 an acre on oats. Both yields and prices declined in the third period, making a loss of 82 cents an acre. Operating expenses advanced sharply during the war period, but declined slightly in the last period because of a reduction in the amount of man labor and horse labor used.

In Champaign and Piatt counties the average yield of oats and average price were slightly below those in Hancock county for the same period (Table 6). The lower operating expenses were offset by the higher charge for interest on land; the result for the period was a net loss of $5.24 per acre.

COST OF CLOVER DURING DIFFERENT PERIODS

The cost data on clover include only those crops which resulted from a fair stand, and do not include clover failures (Table 7 and Fig. 7). The cost of the failures was charged as a loss to the whole farm and not to the clover crop. On some farms three-fourths of the clover seedings failed to secure a sufficient stand to leave for a hay or

TABLE 7.—SUMMARY BY PERIODS OF COST ACCOUNTS ON CLOVER

County	Franklin			Hancock			Champaign and Piatt
Period	1913–16	1917–19	1920–22	1913–16	1917–19	1920–22	1920–22
Expenses per acre							
Man labor	$ 1.64	$ 1.99	$ 2.52	$ 1.54	$ 2.59	$ 3.22	$ 1.56
Horse labor	1.40	1.82	2.17	1.19	2.25	2.01	1.34
Seed	.....	.80	2.22	1.01	1.12	1.51	2.37
Machinery	.45	.36	.46	.51	.75	.91	.72
Hulling	.....	.....	.....	.10	1.24	1.64	.83
General farm expense	.85	1.30	1.51	1.01	1.35	2.50	1.91
Miscellaneous	.....	1.06	1.44	.....	1.09	.12	.....
Total operating expense	4.34	7.33	10.32	5.36	9.39	11.91	8.73
Interest on land at 5%	2.28	2.72	1.95	7.37	8.05	9.48	11.82
Total expense	$ 6.62	$10.05	$12.27	$12.73	$17.44	$21.39	$20.55
Income per acre							
Seed	$	$	$	$ 2.93	$13.70	$ 7.64	$4.90
Hay	9.33	27.47	26.65	6.92	23.98	10.21	10.86
Hullings	.....	.....	.....	1.00	1.15	.80	.47
Pasture	.....	.43	.26	.65	1.89	1.03	2.40
Total income	9.33	27.90	26.91	11.50	40.72	19.68	18.63
Net profit per acre	$ 2.71	$17.85	$14.64	$−1.23	$23.28	$−1.71	$−1.92
Efficiency factors							
Net cost per ton	$ 6.04	$ 6.36	$ 9.15	$ 7.41	$ .57	$14.03	$14.37
Price seed	.....	.....	.....	6.65	21.75	21.80	11.33
Price hay	8.51	18.02	20.13	6.50	17.40	12.00	12.20
Price hullings	.....	.....	.....	5.00	5.00	5.00	3.31
Net profits per ton	2.47	11.66	10.98	.....	.....	.....	.....
Yield—seed	.....	.....	.....	.44 bu.	.63 bu.	.35 bu.	.43 bu.
—hay	1.1 tons	1.53 tons	1.33 tons	1.10 tons	1.38 tons	.85 ton	.89 ton
—hullings	.....	.....	.....	.20 ton	.23 ton	.16 ton	.14 ton
Man labor per acre	11.5 hrs.	10.7 hrs.	9.5 hrs.	9.01 hrs.	10.6 hrs.	10.5 hrs.	6.1 hrs.
Horse labor per acre	16.9 hrs.	14.0 hrs.	10.0 hrs.	13.88 hrs.	12.8 hrs.	12.3 hrs.	8.2 hrs.
Man labor per ton	10.4 hrs.	7.0 hrs.	7.1 hrs.	.....	.....	.....	.....
Total number of acres	96.59	245.48	266.3	310.0	473.04	301.63	448.

seed crop. The more general use of limestone on many of the farms would have decreased the number of failures and increased the yields secured; this fact is borne out by the records of farms which met the requirements of clover in regard to lime and methods of seeding, and secured good stands and yields approximately 80 percent of the time. The use of early varieties of oats as nurse crops increased the certainty of securing good stands of clover.

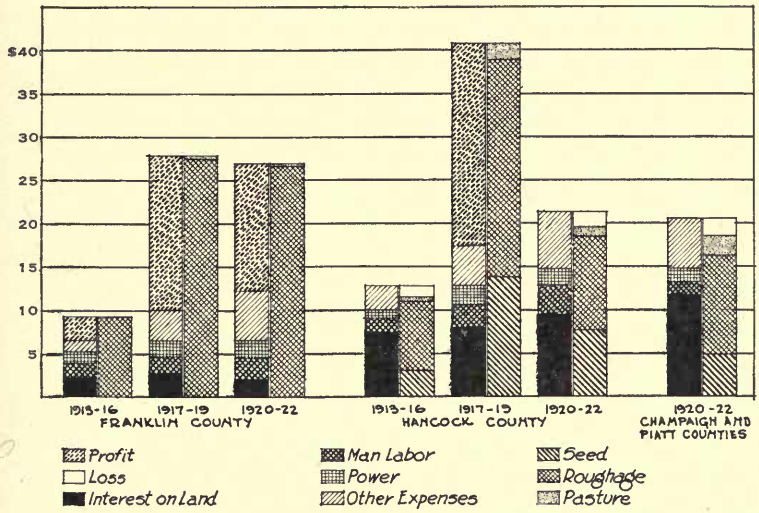


FIG. 7.—COST OF PRODUCING CLOVER IN PRE-WAR, WAR, AND POST-WAR PERIODS

Clover proved its value in the rotation aside from its merits as a soil builder. The application of limestone was essential in securing good stands and good yields.

Clover in Franklin county gave a net profit in each period; $2.71 per acre in the first, $17.85 in the second, and $14.64 in the third. The exceptionally high price of $20.13 per ton in the third period was due to the fact that clover hay was shipped in to some extent, and was valued at market price plus the cost of getting it to the farm. Operating expenses on clover hay showed large increases with each succeeding period. However, it is significant that so valuable a feed as clover hay was produced in Franklin county at the low cost of $6.04 per ton in the first period, $6.36 in the second, and $9.15 in the third.

These results are especially significant, since the acreage of clover on which cost accounts were kept increased during each successive period, altho the total acreage for other crops and the number of farms decreased during the last period. It is evident that the value of the clover crop was becoming more generally recognized.

Clover in Hancock county yielded a net profit of $23.28 an acre in the second period, compared with losses of $1.23 in the first and $1.71 in the third (Table 7). This large profit during the second period was due largely to several good seed crops, the price of which averaged $21.75 per bushel, and to higher yields than in the other periods.

The net loss of $1.92 an acre on clover in the last period in Champaign and Piatt counties was caused largely by the low yield, which averaged only .89 ton of hay and .43 bushel of seed an acre, and by the high charge for land (Table 7). The operating expenses were much less than those in Hancock county for the same period; the yields, while comparable in the two areas, were far below the possible production.

Except for the last period in Hancock and in Champaign and Piatt counties when low yields were secured, clover compared favorably with grain crops in each period of the study. This would indicate that farmers could profitably increase the production of this crop at least to the amount which can be used to advantage on the farm.

VARIATIONS IN COSTS ON DIFFERENT FARMS

The cost of producing crops varies considerably in different parts of the state, largely because of differences in soil, but to some extent because of differences in climate. The net cost of producing a bushel of corn in Franklin county during the ten-year period averaged 90 cents (Table 1), while for the same period in Hancock county it averaged 50 cents (Table 2). The net cost of a bushel of oats in Franklin county averaged 60 cents and in Hancock county 40 cents. Smaller differences prevail for the other crops.

The differences that occur in the cost of producing the same crops in the same areas during different periods under different weather conditions and changing price levels are shown in Tables 4, 5, 6, and 7. The net cost of producing a bushel of corn in Franklin county during the first period averaged 88 cents, in the second period 78 cents, whereas in the third period it increased to $1.30 (Table 4). The net cost of producing a bushel of wheat in Hancock county (Table 5) was $1.35 in the first period, $1.01 in the second, and $1.05 in the third.

IMPORTANCE OF MANAGEMENT IN DETERMINING FARM SUCCESS

Important as these differences are between areas and between different periods, they are not as large as the differences that occur between farms in the same area during the same year on similar soil, and under practically the same weather conditions and price levels. Occasionally such differences are accidental, but as a rule they are due to differences in the managing ability of the farmers. Such variations are apparent from the records in Table 8, which shows the results of cost accounts on corn kept on ten farms in Hancock county in 1922.

In this table the farms are arranged according to the net cost of producing a bushel of corn. The difference of 33 cents between Farm 1, showing the lowest cost, and Farm 10, showing the highest, is due, it will be noted, to a lower acre cost combined with a higher yield per acre.

How yields affect cost may be observed by comparing two farms whose operating expenses are closely comparable but whose yields vary. Farms 1 and 8 illustrate this point very strikingly, for while they varied only slightly in total operating expenses and in the amounts devoted to the different items making up the totals, they varied greatly in yield per acre. Farm 1 produced its corn at an expense of $12.91 an acre, and Farm 8 at $13.28. The number of hours of man labor and the rate per hour were practically the same on the two farms; the hours of horse labor were similar, tho Farm 8 incurred a somewhat higher rate, bringing the expense for this item up to $5.93 an acre compared with $4.69 on Farm 1. Machinery and seed expense were somewhat higher on Farm 1, but this was partially offset by the higher general farm expense on Farm 8. Turning to the records of yields, we find that Farm 1 produced 60.8 bushels of corn to the acre, while Farm 8 produced only 48.5 bushels; the higher yield on Farm 1 brought the cost per bushel down to 28 cents, while on Farm 8 it was 42 cents. Since the operating expenses on the two farms were slightly in favor of Farm 1, we can say that the greater cost per bushel on this farm was clearly due to the fact that the yields were so low.

How differences in operating expense affect the cost of the crop is illustrated by a comparison of Farms 2 and 7. These farms had approximately the same yields—Farm 2 produced 63.8 bushels of corn to the acre and Farm 7, 63.7 bushels. The operating expenses on Farm 7, however, totaled $21.42 an acre, as against $15.12 on Farm 1. Expressed on the bushel basis, the corn on Farm 2 was produced at a cost of 31 cents, and on Farm 7 at a cost of 41 cents. The difference of 10 cents was due mainly to the fact that Farm 7 used more man and horse labor per acre than Farm 2, incurred a higher rate for horse labor, and had higher general farm expenses.

The above farms were selected for illustration because they show the effect which differences in yields and in operating expenses have on the cost of production when each influences the result independently. Differences among farms, however, are usually the net result of differences both in yields and in expenses, as may be observed by further analysis of the figures in Table 8.

Variations similar to those shown for corn could be shown for other field crops also, and in such case the farms in Table 8 would doubtless fall into different ranking, for it frequently happens that a man is more efficient in producing one crop than in producing another.

TABLE 8.—SUMMARY BY FARMS OF COST ACCOUNTS ON CORN, HANCOCK COUNTY, 1922

Farm No.	1	2	3	4	5	6	7	8	9	10
Net cost per bushel	$ .28	$ .31	$ .37	$ .38	$ .39	$ .41	$ .41	$ .42	$ .59	$ .61
Number of acres grown	39.8	64.71	64.36	42.88	95.16	62.62	58.28	47.43	45.99	29.74
Yield	60.8	63.8	49.7	54.0	49.6	58.5	63.7	48.5	36.5	36.5
Labor per acre										
Man hours	17.8	16.3	14.5	20.8	16.4	16.3	20.5	17.2	12.6	19.0
Horse hours	46.5	38.7	39.5	46.1	34.3	43.2	51.8	47.3	22.1	46.0
Tractor hours	....	.64	....	.58	1.2	....	....	....	2.0	1.4
Expenses per acre										
Man labor	$ 4.23	$ 4.48	$ 4.19	$ 5.34	$ 4.49	$ 5.63	$ 5.31	$ 3.95	$ 3.21	$ 4.42
Horse labor	4.69	4.93	5.54	4.81	3.94	6.12	8.27	5.93	5.48	5.18
Tractor	....	.55	....	.34	1.89	....	....	....	1.23	2.82
Seed	.37	.29	.28	.36	.15	.51	.34	.22	.26	.22
Machinery	1.47	1.29	.62	1.44	1.00	.86	1.46	.53	1.00	2.06
General farm expense	2.15	3.37	3.04	3.91	2.14	3.79	6.04	2.65	4.43	2.81
Miscellaneous	....	.21	....	.03	.25	....	....	....	.03	....
Total operating expense	12.91	15.12	13.67	16.23	13.86	16.91	21.42	13.28	15.64	17.51
Interest on land at 5%	7.50	7.50	7.50	7.50	7.50	7.50	7.50	7.50	7.50	7.50
Total expense	$20.41	$22.62	$21.17	$23.73	$21.36	$24.41	$28.92	$20.78	$23.14	$25.01
Income per acre										
Grain	$32.32	$32.52	$26.28	$27.22	$25.78	$32.16	$32.64	$25.68	$19.14	$20.08
Soybeans	2.01	1.30	.15	1.11	.25	....	2.02	....	....	....
Roughage	....	....	....	.53	....	....	....	....	....	....
Pasture	.56	1.39	2.72	1.37	1.42	.64	1.04	.21	1.51	2.72
Total income	34.89	35.21	29.15	30.23	27.45	32.80	35.70	25.89	20.65	22.80
Net profit per acre	$14.48	$12.59	$7.98	$6.50	$6.09	$8.39	$6.78	$5.11	$–2.49	$–2.21

Managerial ability, therefore, must be measured by the average net income per acre secured from all products. It means the ability to choose the more profitable crops, to determine the proportion of each to grow, and to produce each efficiently. Variations in managerial ability, as expressed in each of these factors, result in wide differences in the total net income from farms, and over a period of years may mean success or failure.

APPLYING THE RESULTS OF COST-OF-PRODUCTION STUDIES

Cost-of-production studies conducted in a region over a period of years are valuable in showing the relative profitableness of crops. This information, together with a knowledge of local conditions, may well be used as a basis for planning profitable cropping systems.

A study of the changes in the cost of producing crops and in the incomes from them from year to year during a period when prices are changing, shows the importance of studying price relationships if one is to keep his farm practices so adjusted as to realize the highest returns from the farm as a whole.

The importance of management as a factor in determining farm same crop on farms located in the same community and operated success is demonstrated by variations in the cost of producing the under similar climatic conditions.